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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/923,670	08/07/2001	Hag-ju Cho	5649-877	1538

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EXAMINER
THOMAS, TONIAE M

ART UNIT	PAPER NUMBER
2822	12

DATE MAILED: 06/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/923,670	CHO ET AL.	
	Examiner	Art Unit	
	Toniae M. Thomas	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 March 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *42-77* is/are pending in the application.

4a) Of the above claim(s) *42-57* is/are withdrawn from consideration.

5)☒ Claim(s) *62-69 and 77* is/are allowed.

6)☒ Claim(s) *58-60,70-72 and 76* is/are rejected.

7)☒ Claim(s) *61 and 73-75* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. This action is an official response to the amendment filed on 24 March 2003 as Paper No. 11. The amendment added claims 73-77. Currently, claims 42-77 are pending. Claims 42-57 have been withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made without traverse in Paper No. 9.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. *Claims 58, 71, 72, and 76 are rejected under 35 U.S.C. 102(e) as being anticipated by Yu (6,284,588 B1).*

Yu discloses a method of forming a capacitor in a non-volatile memory device, wherein the capacitor comprises a ferroelectric dielectric region 16 (figs. 2A-2E and accompanying text). The method comprises the following steps substantially as claimed: depositing a first metal oxide layer 17 directly on the ferroelectric dielectric region 16, wherein the first metal oxide layer is formed of a different material from that of the ferroelectric dielectric region (fig. 2D and col. 3, lines 13-17); annealing the first

metal oxide layer 17 and the ferroelectric dielectric region 16 (col. 3, lines 13-17); and forming an upper electrode by depositing a conductive layer 19 on the first metal oxide layer 17 (fig. 2F)[1]. Yu teaches that the conductive layer 19 may comprise a metal oxide layer (col. 3, line 56 – col. 4, line 3).[2] In the embodiment which conductive layer 19 comprises a metal oxide layer, conductive layer 19 forms a second metal oxide layer on the first metal oxide layer 17.

Yu clearly shows that the conductive layer 19, which in at least one embodiment forms a second metal oxide layer, is formed to a thickness which is greater than that of the first metal oxide layer 17 (fig. 2F)

The ferroelectric dielectric region 16 is a capacitor dielectric.

The ferroelectric dielectric region 16 comprises $Pb(Zr, Ti)O_3$ (col. 3, lines 7-12).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. *Claims 59 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu.*

Yu does not teach that the first metal oxide layer 17 is sufficiently thin enough to enable a remnant polarization of the ferroelectric dielectric region 16 to increase during

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[1] The conductive layer is considered formed on the first metal oxide layer 17 because the conductive layer 19 contacts the sidewalls of the first metal oxide layer 17 exposed in the opening formed by selectively etching the first metal oxide layer and the silicon oxide layer 18 (fig. 2E).

the annealing of the first metal oxide layer and the ferroelectric dielectric region. However, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to form the first metal oxide layer such that it is sufficiently thin enough to enable the increase of a remnant polarization of the ferroelectric dielectric region 16 during the annealing of the first metal oxide layer and the ferroelectric dielectric region, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering an optimum value of a result effective variable involves only routine skill in the art (*In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

4. *Claim 60 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu in view of Emesh et al. (US 5,728,603 B1).*

As discussed above, Yu discloses an annealing step, wherein the first metal oxide layer 17 and the ferroelectric dielectric region 16 are annealed at a temperature between approximately 450°C and 750°C (col. 3, lines 13-17). However, Yu does not teach that the annealing of the first metal oxide layer and the ferroelectric dielectric region is done in a manner sufficient to increase the remnant polarization of the ferroelectric dielectric region.

Emesh et al. disclose a method for forming a crystalline ferroelectric dielectric film. The process comprises an annealing step, wherein the anneal is performed at a temperature above 600°C to transform the ferroelectric dielectric film from a non-ferroelectric cubic phase to a ferroelectric phase and, thereby, increase the remnant

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[2] The metal oxide film may comprise an oxide of the following metals: Ru, Ir, Re, La, Sc, or Co.

polarization of the ferroelectric dielectric film (col. 7, lines 8-23). As deposited, a ferroelectric dielectric film has no remnant polarization, that is, it is not ferroelectric (col. 7, lines 16-18).

It would have been obvious to one having ordinary skill in the art, at the time the invention was made, to anneal the first metal oxide layer and the ferroelectric dielectric region in a manner sufficient to increase the remnant polarization of the ferroelectric dielectric region because, as Emesh et al. teaches, the as-deposited ferroelectric dielectric region 16 has no remnant polarization (Emesh et al. – col. 7, lines 16-18). The ferroelectric dielectric region in a non-volatile memory device must have remnant polarization.

5. *Claim 70 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu in view of Melnick et al. (US 6,107,136 B1).*

As discussed above, Yu discloses depositing a first metal oxide layer 17 directly on the ferroelectric dielectric region 16, and depositing a second metal oxide layer 19 on the first metal oxide layer. The first metal oxide layer 17 comprises $SrTiO_3$, and the second metal oxide layer 19 may comprise an oxide of metals such as Ru, Ir, Re, La, Sc, or Co. However, Yu does not teach that the first metal oxide layer and the second metal oxide layer are deposited using one of an atomic layer deposition method, a low pressure CVD method, a high pressure CVD method, or a plasma CVD method.

Melnick et al. disclose a method for making a capacitor. Melnick et al. teach depositing $SrTiO_3$ and oxides of metals such as Ru, Ir, Re, La, Sc, and Co using a CVD method (col. 3, line 63 – col. 4, line 11 and col. 8, lines 29-40).

It would have been obvious to one having ordinary skill in the art, at the time the invention was made, to deposit the first metal oxide layer and the second metal oxide layer using CVD, as taught by Melnick et al., because CVD is one deposition method commonly used to deposit metal oxides.

Allowable Subject Matter

6. Claims 62-69 and 77 are allowable.

7. Claims 61 and 73-75 are objected to as being dependent upon a rejected base claim, claim 58, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

8. Applicant's arguments with respect to claims 58-77 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (703) 305-7646. The examiner can normally be reached on Monday through Thursday from 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (703) 308-4905. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

TMT
May 29, 2003

AMIR ZARABIAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800